

## The role of knowledge management strategies and task knowledge in stimulating service innovation

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# THE ROLE OF KNOWLEDGE MANAGEMENT STRATEGIES AND TASK KNOWLEDGE IN STIMULATING SERVICE INNOVATION

Chris Storey  
Reader  
Cass Business School  
City University  
106 Bunhill Row  
London EC1Y 8TZ  
United Kingdom  
+44 (0)20 70408728  
c.d.storey@city.ac.uk

Kenneth B. Kahn, Ph.D.  
Professor  
Virginia Commonwealth University  
School of Business  
P.O. Box 844000  
Richmond, Virginia 23284  
804-828-9944  
kbkahn@vcu.edu

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# **THE ROLE OF KNOWLEDGE MANAGEMENT STRATEGIES AND TASK KNOWLEDGE IN STIMULATING SERVICE INNOVATION**

## **ABSTRACT**

Are service firms that enact strategies to manage their new service development (NSD) knowledge able to generate a sustainable competitive advantage (SCA)? Based on analysis of data from a large survey of service companies, the answer is yes. We find that companies employing the knowledge management strategies of codification and personalization reflect higher levels of NSD knowledge. However, the two strategies vary in their individual performance outcomes, with codification promoting NSD proficiency (an ability to execute NSD activities) and personalization promoting greater NSD innovativeness (market perception of the company as novel and as an innovator). When used together, the two strategies magnify NSD knowledge, which when combined with NSD proficiency and NSD innovativeness, promote a SCA. Therefore, companies planning to invest in a knowledge management system should heed the outcomes desired from their NSD process. A system based on documentation exemplifies a codification strategy and will drive NSD proficiency; a system emphasizing interpersonal communication exemplifies a personalization strategy and will drive NSD innovativeness. A system that blends the two strategies appears the most advantageous for service companies' NSD efforts aiming to build a long-term sustainable competitive advantage.

Keywords: Service development, Knowledge management

# **THE ROLE OF KNOWLEDGE MANAGEMENT STRATEGIES AND TASK KNOWLEDGE IN STIMULATING SERVICE INNOVATION**

## **INTRODUCTION<sup>1</sup>**

Service firms have invested considerable sums in knowledge management strategies, purchasing and implementing systems offered by such companies as Microsoft, SAP, and Sopheon. Some of these systems are designed to aid service innovation through documenting past and current new service development (NSD) initiatives. Other systems emphasize and enhance personal interaction and teamwork during NSD. A pending question is whether the strategy employed matters to improving a service firm's NSD performance and enables a sustainable competitive advantage (SCA)? Might a particular knowledge management strategy manifested through a system vary (or not vary) with regards to NSD proficiency and NSD innovativeness, and in turn, have varying impact on the firm's SCA?

The present research addresses these questions and provides insight into the NSD performance outcomes afforded by the two knowledge management strategies called codification and personalization (Hansen, Nohria and Tierney 1999). Codification is a strategy where knowledge is formally documented and archived, whereas personalization is a strategy that emphasizes personal reflection and interaction. If each strategy affords similar NSD performance outcomes, managers can choose between the two strategies. However, if each strategy has unique NSD performance outcomes, then managers need to carefully implement their knowledge management strategies with an

eye towards what type of NSD performance outcome is being sought. Indeed, both knowledge management strategies may be needed.

This issue is particularly important for service firms which face special challenges in capturing knowledge for innovation due to their intangible and inseparable nature (Dougherty 2004). The output of a NSD effort is the service delivery process rather than the service itself (Edvardsson and Olsson 1996), and in many instances the precise service is customized and augmented at the point of delivery. Accordingly, innovation in services needs to be distributed throughout the organization (Lyons, Chatman and Caneel 2007), and downstream functions such as operations and customer service need to be involved early in the development process for the effective implementation and delivery of new services. As the interdependence among functional units increases, the volume of knowledge sharing needs to increase (De Luca and Atuahene-Gima 2007). Therefore, the relative the importance of strategies to collate and integrate knowledge is likely to be higher in NSD contexts.

The paper begins with a discussion of knowledge management strategies, their proposed relationships with NSD task knowledge, NSD performance outcomes, and the firm performance outcome of SCA. Empirical results from a study involving 121 service companies are then presented. We conclude with study implications for managers and researchers.

Undertaking this research endeavors to improve understanding of how operant resources can drive a SCA. As will be discussed, we find that a firm's existing stock of knowledge does not alone lead to a SCA *per se*, but would appear to promote a SCA alongside more proficient execution of service innovation activities and a perceived

positional advantage of innovativeness in the marketplace. Building on the knowledge-based theory of the firm, the study demonstrates the importance of managing knowledge as both a stock and process, and how these working in conjunction with each other can improve organizational performance. For managers, understanding the performance outcomes from different knowledge strategies is invaluable for decisions pertaining to investments by service organizations in NSD knowledge management systems and service innovation processes.

### **KNOWLEDGE MANAGEMENT STRATEGIES**

Figure 1 presents a framework showing that the operant resources comprising knowledge management strategies and NSD task knowledge lead to NSD performance outcomes, represented by NSD proficiency and NSD innovativeness, and in turn, contribute to firm performance, represented by a SCA.

--- Insert Figure 1 About Here ---

Knowledge management strategies are the formal processes and structures firms employ to collect, interpret, and internalize knowledge. New knowledge from past and current NSD projects is converted to existing knowledge by way of exchange networks and integration mechanisms (De Luca and Atuahene-Gima 2007; Zahra and Nielsen 2002). Hansen, Nohria, and Tierney (1999) identify two knowledge management strategies – a codification strategy and a personalization strategy - that firms employ to exploit their explicit and tacit knowledge.

A codification strategy represents explicit knowledge transmitted in a formal, systematic language. Characteristic of a more formal, mechanistic approach, a

codification strategy is a document-centred strategy where organizations accumulate, codify, and store individual knowledge in NSD manuals, project reports, and best practice databases, for collective current and future use (Garud and Nayyar 1994). The storing of intelligence, normally via computer systems, is popular due to the explosion of information capabilities, which allows for instant access to that NSD intelligence by company personnel across the organization. However a codification strategy is more than simply storing it in documents and the like, it is the embodiment of tacit knowledge into NSD processes and practices (Grant 1996). The integration of knowledge into organizational routines and processes provides a platform for ongoing process improvements as new approaches are tried and new procedural knowledge is incorporated into the processes (Mohrman, Finegold and Mohrman 2003).

The second strategy is called a personalization strategy (Hansen, Nohria, and Tierney 1999). Individuals share their knowledge with other people in the organization through person-to-person interactions and personal relationships. A personalization strategy may involve both formal mechanisms (e.g. project meetings, corporate away days) and informal mechanisms (e.g. unscheduled meetings, coffee break conversations). A personalization strategy results in the sharing of tacit knowledge, which is hard to articulate, acquire, and store within individuals without direct personal experience (Szulanski 1996). It is through this person-to-person socialization that NSD personnel can share mental models, unify cross-functional understanding, and combine individuals' knowledge in new and different ways to give shared meaning (Nonaka 1994).

Task knowledge in the context of service innovation is the accumulation of facts, insights, experiences, and lessons learned from previous and emergent service

development activities and originating from different functions within the company. Such knowledge manifests itself in the routines for team cooperation, procedures for project milestones, skills in market assessment, prototyping techniques, concept testing methodologies, etc. As suggested by research, knowledge management strategies directly influence the level of NSD task knowledge the firm possesses because such strategies aim to acquire, capture and distil knowledge, thereby increasing the level of NSD task knowledge available to the firm (De Luca and Atuahene-Gima 2007).

The following two hypotheses are offered:

H1a: A codification strategy will increase NSD task knowledge.

H1b: A personalization strategy will increase NSD task knowledge.

Normative research suggests that companies will favor either a codification strategy or a personalization strategy (Hansen, Nohria and Tierney 1999). However, because a personalization strategy encourages the accumulation of tacit knowledge whilst a codification strategy favors explicit knowledge, both are needed in a company attempting to build its NSD knowledge base. Both strategies also are likely to interact and reinforce each other. Personal discussions can correct misunderstandings in written documents; minutes of team meetings allow people who could not be present to be brought up to speed. Firms that rely on one strategy or another may miss some of the benefit of their knowledge resources. If a firms' knowledge strategy is managed as an interconnected operant resource blending a personalization strategy and a codification strategy to reinforce each other strategy, the firm is more likely to be able to produce efficiently and effectively valued market service offerings (Madhavaram and Hunt 2008).

Hypothesis 2 is offered:



H2: NSD task knowledge will be increased to a greater extent by employing both a codification strategy and a personalization strategy than when just a single strategy is employed.

### **INNOVATION PERFORMANCE OUTCOMES**

Efficiency and effectiveness are the two crucial dimensions for assessing innovation performance (Olson et al. 2001). Efficiency can be measured through NSD proficiency, which is characterized as the quality of executing NSD activities. NSD proficiency is defined as the efficiency exhibited through budget adherence, on-time delivery of project deliverables, and meeting project specifications. Effectiveness can be measured by NSD innovativeness, which refers to the creation of superior value as perceived by the marketplace and captures a positional advantage (Day and Wensley 1988). NSD innovativeness reflects the notions of flexibility and novelty in service innovation (Atuahene-Gima 2005).

Knowledge management strategies should influence the innovation outcomes of the firm – both directly and through NSD task knowledge, but because these strategies accumulate and process knowledge differently, it is suggested that they influence an organization's NSD performance outcomes in different ways (Subramaniam and Youndt 2005). A codification strategy would be most suitable for enhancing NSD proficiency due to the focus on routines and standardization surrounding the process. For example, firms that are good at recording development information and retrieving such information reflect improved product development and launch proficiency (Lynn, Simpson and Souder 1997; Sherman, Berkowitz and Souder 2005). A codification strategy attempts to streamline

knowledge so that proficiency is achieved during the decision-making process. Froehle et al. (2000) found that a reproducible formal development process increases proficiency in terms of the speed of development.

While prone to proficiency, use of a codification strategy runs the risk of losing the original value of the idea (Boisot 1995). Brown and Eisenhardt (1997) found that firms with highly codified processes such as gating procedures produced new products quickly, but that those products often were not well adapted to market conditions. Task knowledge accumulated in and utilized through an organization's databases, systems, and processes seems to help it reinforce its prevailing knowledge and augment incremental innovative capabilities (Subramaniam and Youndt 2005). Similarly, Marsh and Stock (2006) found that retaining knowledge via a recording strategy does not directly increase innovation performance, but instead, encourages further knowledge acquisition during the development process. This supports the view that a codification strategy does not achieve a positional advantage in the form of NSD innovativeness and that it be more appropriate for aiding an exploitation strategy rather than an explorative strategy. We posit:

H3: Use of a codification strategy leads to greater NSD proficiency.

NSD involves a number of tasks that call for creative solutions, which requires improvisation and flexibility in the use of knowledge (Eisenhardt and Tabrizi 1995; Moorman and Miner 1998). Those organizations that exchange knowledge firsthand are more able to select and employ knowledge appropriately, leading to higher degrees of creativity and sustained confidence in the abilities to pursue innovative strategies

(Calantone, Cavusgil and Zhao 2002). Personalized knowledge also increases the chances of using prior knowledge in a less standard fashion, leading to more innovative solutions (Kyriakopoulos and de Ruyter 2004). In addition, a personalization strategy more deeply involves different functional areas in the development process (Avlonitis, Papastathopoulou and Gounaris 2001) and enhances connectedness among functional units to ensure the effective use of the firm's innovation competencies to engender radical outcomes (Atuahene-Gima 2005).

While a personalization strategy implies a working environment with extensive collaboration and personal communication, it is unlikely to be efficient due to the time-consuming nature of face-to-face exchanges. Jassawalla and Sashittal (2002) found that highly innovation-supportive cultures have intensive schedules of formal meetings for sharing information, exchanging and developing ideas, expressing disagreement, and managing conflict. Hypotheses H4 is offered:

H4: Use of a personalization strategy leads to greater NSD innovativeness.

Regarding NSD task knowledge, research finds that those companies with more knowledge about a particular process will likely be better at performing that respective process (e.g. Cohen and Levinthal 1990; March 1991). NSD task knowledge when incorporated into routines and standard approaches should speed up execution, reduce development costs, and increase the quality of the development process (e.g. Kyriakopoulos and de Ruyter 2004; Montoya-Weiss and Calantone 1994). NSD task knowledge also should help integrate company knowledge collectively, decreasing errors,

reducing the duplication of effort and leading to a superior solution (Akgun, Dayan and Di Benedetto 2008).

There is mixed evidence as to the impact of task knowledge on the degree of innovation for NSD activities. Research has suggested a positive relationship (Akgun, Dayan and Di Benedetto 2008; Kusunoki, Nonaka and Nagata 1998; Moorman and Miner 1997), a negative relationship (Subramaniam and Youndt 2005) or the absence of a relationship (Kyriakopoulos and de Ruyter 2004). It is contended that firms with an existing stock of NSD knowledge may be in a better position to make further breakthroughs and add to their existing stock of knowledge than firms with low initial levels of know-how (Bharadwaj, Varadarajan and Fahy 1993). Prior knowledge also enhances knowledge creation capability (Smith, Collins and Clark 2005), and enhances a company's ability to assess and import new outside information enhancing project innovativeness (Moorman and Miner 1997).

However, deep levels of knowledge and experience can act as a perceptual filter hindering the firm's ability to assimilate knowledge creating core rigidity (Leonard-Barton 1992). Reuse of existing knowledge is more problematic in situations requiring high novelty because the existing relationships between specialized pieces of knowledge can breakdown (Carlile and Rebentisch 2003). In light of core rigidity being less likely a problem in service firms, due to their relative inexperience in innovation and lack of NSD knowledge representing a main barrier to innovation (Kelly and Storey 2000), we posit the following:

H5a: NSD task knowledge increases NSD proficiency.

H5b: NSD task knowledge increases NSD innovativeness.

## **FIRM PERFORMANCE**

A SCA is conceived as that range of outcomes from the firm's innovation activities that enables the firm to achieve superior market advantages and resist erosion by competitors (Bharadwaj, Varadarajan, and Fahy 1993). These outcomes include the establishment of new markets, the attraction and retention of customers, increased customer loyalty, cost efficiencies, and brand reputation.

Companies reflecting NSD proficiency and NSD innovativeness should enjoy a SCA (Corso et al. 2001; Grant 1996). NSD proficiency will result in timely, cost-effective decisions that can create a better utilization of existing resources, enhanced profitability and also result in the creation of higher quality new services leading to long-term benefits. NSD innovativeness provides more market leading offerings that create a unique position in the marketplace (Moorman and Miner 1998; Im and Workman 2004). The following two hypotheses are proposed:

H6: NSD proficiency will lead to a sustainable competitive advantage.

H7: NSD innovativeness will lead to a sustainable competitive advantage.

NSD task knowledge is also proposed to have a direct effect on SCA. A lack of skills and expertise required to undertake NSD restricts a firm's ability to exploit the opportunities open to them. As Adler, Riggs and Wheelwright (1989, p 12) observed, know-how "built-up over a number of years and diffused throughout the organization" facilitates efforts to develop future new products and services. The firm's organizational memory will give the firm confidence in their own abilities and also make their innovation activities more efficient increasing their development capacity. This is likely to increase the level of innovation activity in the organization and add to the firm's SCA. Therefore,

H8: NSD task knowledge will lead to a sustainable competitive advantage.

To summarize, we argue that a stock of existing NSD task knowledge is developed by the firms' knowledge management strategies of codification and/or personalization. Yet, because knowledge is a necessary but not a sufficient condition for competitive advantage (De Luca and Atuahene-Gima 2007), NSD proficiency and NSD innovativeness mediate the effect that NSD task knowledge and the knowledge management strategies a firm employs on a SCA. This exemplifies that knowledge management strategies shape NSD activities, which in turn, manifest NSD performance outcomes that then contribute to a firm's SCA.

## **METHODOLOGY**

### **Sample and Procedure**

A questionnaire survey was designed to test the conceptual model. The survey sample comprised of 385 UK-based service businesses. These were the largest organizations across various sectors. In each business the Marketing Director or the director in charge of NSD served as the key informant because of their organizational knowledge and access to relevant information. The key informant approach was employed due to the precedent of its use in this type of research (cf. Moorman and Miner 1997). The development of the questionnaire was pretested with a small number of marketing directors to ensure understanding of the questionnaire and determine if respondents possessed sufficient knowledge to answer. Following two survey mailing waves, a total of 121 completed questionnaires were returned, equating to a 32%

response rate<sup>2</sup>. To ensure the validity of the data, the data was tested for sector and firm size differences between respondents and non-respondents. Differences between early and late respondents for all constructs in the model were tested for. No systematic differences were identified suggesting non-response bias was not a significant issue (Armstrong and Overton 1977).

## **Measurement**

Where possible, scales were taken from previous research and adapted to the NSD context. Scales developed specifically for this research were based on the literature as outlined in the conceptual model. The final version of the questionnaire was pretested with a holdout sample of Marketing Directors, a number of senior managers with a leading consultancy firm, and a panel of expert academics to ensure content validity. All scale items were assessed on 7-point Likert scales and are reflective except NSD proficiency. See the appendix for a complete list of measures used.

*Personalization Knowledge Strategy* (5 items): A personalization strategy encompasses key processes that enable the sharing of tacit knowledge (Nonaka 1994). These are team-based NSD projects, formal group meeting, team-based problem solving, intra-departmental co-operation and communication (De Luca and Atuahene-Gima 2007; Goh and Richards 1997; Subramaniam and Youndt 2005).

*Codification Knowledge Strategy* (5 items): A codification strategy was conceptualized as the extent to which the firm adopt a “people-to-documents” approach to knowledge with formal procedures to document learning from past projects rather than allowing knowledge to remain solely with the individual. Here explicit knowledge is stored

as formal processes, in reports, and in NSD manuals (Grant 1996; Lynn, Simpson and Souder 1997; Marsh and Stock 2006).

*NSD Task Knowledge* (3 items): The NSD knowledge the firm possess was operationalized by measuring the amount of knowledge, the degree of experience, and the investment made in NSD. This is Moorman and Miner's (1997) organizational memory scale adapted to the specific context of NSD task knowledge.

*NSD proficiency* (5 items): The proficiency of the firms NSD processes was assessed by how good it is at carrying out four distinct stages of the NSD process and proficiency of NSD project management. These stages are commonly cited by the NSD literature (e.g. Avlonitis, Papastahopoulou and Gounaris 2001; John and Storey 1998; Thomke 2003). As this research concentrated on the internal processes, we deliberately excluded the market orientated tasks. This was considered a formative scale as the items determine the latent variable rather than being caused by it (Diamantopolous and Winklhofer 2001).

*NSD Innovativeness* (3 items): NSD innovativeness is defined as a positional advantage of novelty and originality. This takes an output view of innovativeness and comprises the degree of project innovativeness within the firm, the generation of innovative ideas, and the creation of positive perceptions (Froehle et al. 2000; Kusunoki, Nonaka and Nagata 1998; Nijssen et al. 2006; Storey and Easingwood 1999).

*Sustainable Competitive Advantage* (7 items): SCA is measured as the combination of a range of outcomes that give the firm long-term benefits (Bharadwaj, Varadarajan and Fahy 1993; Day and Wensley 1988). These range from the development of new markets to the better utilization of existing resources. Similar measures have been



used extensively in NPD and NSD research as the outcomes of innovation activity (e.g. Cooper et al, 1994; Montoya-Weiss and Calantone 1994). High scores on the competitive advantage scale suggest that the firms' NSD activities have enabled the firm to achieve superior market advantages and competitors are unable to duplicate the firm's capabilities on which the advantages have been founded (Weerawardena and O'Cass 2004).

*Service Sector:* Using data collected on industry sector, firms were grouped according to whether their respective service was characteristically delivered by technology or interpersonal interactions. This allowed for consideration of the nature of the service organization in analyses. The former group (termed *explicit services*) comprised banking, insurance, telecommunications, on-line retailing and utilities firms (n = 63); the latter group (*tacit services*) comprised professional services, transportation, retailing and IT consultancy firms (n = 58).<sup>3</sup>

*Controls:* Two control measures were included - market turbulence and technology turbulence - based on scales used in similar studies on innovation (e.g. De Luca and Atuahene-Gima 2007).

## **ANALYSIS and RESULTS**

SmartPLS v2.0 (Ringle et al. 2005) was used to obtain partial least squares (PLS) estimates for both the measurement and the structural model. PLS path modeling was employed as it does not require multivariate normal data, can accommodate the use of formative indicators, and is more suitable for small samples (Chin 1998; Fornell and Bookstein 1982). Based on the recommendations by Green (1991), for a model with 7 indicators (the largest number of loadings on a construct), assuming a large effect size

( $R^2 = 0.26$ ), a significance level of 0.05 and a desired power of 0.80 in our analysis, a minimum sample size of 44 is required. The sample of 121 exceeds this, and exceeds the more conservative recommendation of 10 times the largest number of loadings (Chin 1998)

### **Measurement Model**

Before testing the hypothesized structural model it is important to test the reliability, convergent validity and discriminate validity of the measurement model. An exploratory factor analysis on all items in the study was conducted with the number of factors based on eigenvalues greater than 1. Items were removed if they failed to achieve a loading of 0.5 on a factor or if an item loaded onto more than one factor. This resulted in a six factor solution that corresponded to the hypothesized model. The factor patterns revealed that the items load cleanly on their intended constructs providing evidence of discriminate validity. The first factor accounted for 35% of the total variance. As no one factor accounted for the majority of the variance, common method bias does not appear to be a significant problem (Podsakoff and Organ 1986).

Coefficient  $\alpha$  was calculated for each construct (see appendix) and was found to be greater than the recommended minimum of 0.7 indicating high reliability (Hair et al. 2007). The standardized loadings from the PLS model were all 0.6 or above and significant at the 0.01 level thus providing evidence for convergent validity (Chin 1998; Tenenhaus et al. 2005). We also confirmed that no item had a higher cross-loading on another construct than its loading on its intended construct. The composite reliability (CR)

was calculated for each factor. These ranged from 0.77 to 0.91, well above acceptable levels (Chin 1998; Hair et al. 2007).

Discriminant validity was assessed by examining whether each construct shared more variance with its measures than with other constructs in the model (Chin 1998). All the constructs reached the average variance extracted (AVE) level of 0.60 which is considered desirable (Bagozzi and Yi 1988). This was compared to the highest shared variance (HSV) with the other factors in the model. The AVE was always greater than the HSV supporting validity of the model (Fornell and Larcker 1981). Correlations between all latent variables are shown in Table 1.

--- Insert Table 1 About Here ---

NSD proficiency indicator validity was assessed by correlating the indicators with a theoretically related variable i.e. SCA (Diamantopolous and Winklhofer 2001). All indicators showed a significant positive correlation. In a formative scale, items are not required to be intercorrelated and excessive collinearity needs to be ruled out to ensure the direct influence of each scale item in the latent variable. In addition if indicators are non-significant, they cannot be considered valid measures of the construct (Diamantopolous and Winklhofer 2001). Based on the variance inflation factors and t-statistics, the item pertaining to implementation was removed. Inspection of the remaining indicators revealed sufficient breadth of coverage for capturing the content of the construct which concentrated on the internal development processes up to the point of commercialization.

## **Structural Model**

As shown above the analysis of the psychometric properties of the measurement scales indicates that they are reliable and demonstrate high levels of validity. Therefore it is acceptable to test the hypothesis via a PLS path model. To test the stability and statistical significance of the parameters estimates (t-values) in the structural model, we used a bootstrapping procedure with 500 re-samples (Chin, 1998). None of the controls had a significant relationship with SCA. A positive relationship was found with technical turbulence and NSD innovativeness and a negative relationship between the sector and NSD proficiency. Accordingly, the market turbulence was excluded from the final model.

The conceptual model suggests an interaction effect between personalization and codification strategies magnifying their effect on NSD knowledge when both strategies are employed. To test for this effect, a residual centering approach was employed in accordance with the recommendations of Lance (1988), who indicates residual centering as having the advantage of minimizing multicollinearity between the interaction term and its component variables. The residual centering technique involves regressing the interaction term on its two components via ordinary least squares and then using the residuals of this regression in the structural model instead of the interaction term (Groth, Hennig-Thurau and Walsh 2009). The result of the PLS for the final model including the interaction terms is shown in Table 2.

To investigate the relative importance of the independent variables and mediating variables on the dependent variables, it is important to look at both the direct and indirect effects that together make up the total effect of an explanatory variable on a dependent variable (Kilne 2001). If any indirect effect does not receive proper attention the relationship between two variables may not be fully considered. The total effects are

shown in Table 2. To assess the model the  $R^2$  values of the endogenous variables were investigated (Cohen 1988; Tenenhaus et al. 2005). In accordance with the categorization of  $R^2$  effect sizes (small 0.02, medium 0.13, large 0.26) we can conclude that the average  $R^2$  (0.41) can be considered to be a large effect. As recommended by Tenenhaus et al. (2005) a goodness-of-fit measure ( $\sqrt{\text{ave } R^2 * \text{ave VE}}$ ) was calculated. Assuming a large average effect size for  $R^2$  (0.26) and a cut-off value of VE of 0.70 we obtain a comparison value of 0.43. The goodness of fit calculated was 0.52 acknowledging this model fit to be good.

--- Table 2 About Here ---

As can be seen in Table 2, strong relationships were found between the knowledge strategies and NSD task knowledge providing support for Hypothesis 1a and 1b. As posited, the interaction between personalization and codification has a marginal but significant effect on NSD knowledge. Comparing a model with the interaction term to a model excluding the interaction term,  $R^2$  for NSD task knowledge decreases from 0.378 to 0.361 ( $\Delta F$  3.20; sig 0.08). The effect size of the interaction terms in the final model suggest a statistically significant, albeit minor, effect size ( $f^2 = .027$ ) (Chin, Marcolin and Newsted 2003; Cohen 1988). This provides support for H2.

NSD proficiency is associated with existing knowledge and a codification strategy supporting H3 and H5a. Surprisingly the sector has a significant negative influence on NSD proficiency. Sectors with service offerings based on tacit knowledge are less proficient at NSD. 48% of the variance in NSD proficiency is predicted by the model.

Innovativeness is predominately driven by the level of NSD knowledge and the firm's personalization strategy. This supports H4 and H5b. Technical turbulence also

has a significant impact on NSD innovativeness. The greater the technical change occurring the greater the need (or the greater the opportunity) to be innovative. Together these account for 37% of the variance in innovativeness.

The results show that NSD knowledge acts as a partial mediator in the way the knowledge strategies influence innovation performance. Sobell tests were conducted to examine the partial-mediation of NSD task knowledge on the personalization-innovativeness relationship (3.30,  $p=0.00$ ) and the codification-proficiency relationship (3.72,  $p=0.00$ ). The knowledge strategies increase the firms stock of knowledge. This knowledge is then used to develop more innovative new services and become more proficient in their development.

The conceptual model expected the firm's NSD proficiency and innovativeness to mediate the relationship between the firm's NSD task knowledge and its competitive advantage. A direct relationship was found between NSD knowledge and SCA as well as with the two innovation performance measures and SCA supporting H6-8. A significant Sobell test was found for the partial-mediation of Innovativeness (2.59,  $p=0.01$ ) and NSD proficiency (1.74,  $p=0.08$ ). Together, NSD proficiency, NSD innovativeness, and NSD knowledge (directly and indirectly) account a large proportion (41%) of the variance in SCA.

To further test the hypothesized model we opened up the model to examine non-hypothesized relationships. As expected, the relationships between codification and both NSD innovativeness and SCA were non-significant, as was the relationship between personalization and NSD proficiency. However, a significant relationship was found between use of a personalization strategy and SCA ( $\beta = 0.24$ ,  $t = 2.69$ ). The amount of

SCA explained increases to 45% ( $\Delta F$  3.20; sig 0.08;  $f^2 = .073$ ) representing a small to medium effect size (Chin, Marcolin and Newsted 2003). All existing relationships remain significant. This suggests that a personalization strategy may play a role in sustaining a SCA through the personal sharing of knowledge that parallels the contributions of NSD task knowledge and NSD innovativeness. This finding also may imply a more predominant role for personalization in directly sustaining a SCA. Future research should keenly study to clarify the benefits afforded by a personalization knowledge management strategy.

### **Post hoc Analysis: Sector Effects**

Because services are not all the same, a post hoc analysis was conducted to assess possible service sector effects. Some services such as Banking and Telecommunications are heavily standardized and dependent on technology, which would be predicated on codified knowledge. Other services are more heterogonous and involve interpersonal interactions, which makes them more dependent on knowledge expressed from person-to-person. To explore a possible moderating effect by sector, a hierarchical analysis was conducted on the relationships between the two knowledge strategies and innovation performance using the residual centering approach.

As shown in Table 3, sector appears to have a significant affect on the relationship between personalization and NSD innovativeness. The interaction term is statistically significant and reflects a positive relationship, with  $R^2$  increasing from 0.375 (M1) to 0.401 (M2). The interaction term of codification and sector shows a significant positive relationship with NSD proficiency;  $R^2$  increases from 0.481 (M3) to 0.495 (M4). These

results suggest that the impact of personalization on innovativeness is greater in the case of services predicated on interpersonal knowledge. However, the impact of codification on proficiency is also greater in the case of these types of services; the expectation was that the latter would be significant in the case of technology-based services. It would appear that services predicated on interpersonal interactions benefit more from both types of knowledge management strategies than those service firms heavily reliant on technology. This infers that knowledge management strategies are particularly crucial for stronger NSD performance when the service itself is organic in nature, e.g., predicated on interpersonal interactions.

--- Table 3 About Here ---

## **DISCUSSION and CONCLUSIONS**

This research refines and extends our comprehension of how operant resources drive a SCA. A firm's existing stock of knowledge does not simply create a SCA *per se* but enables this to be created via more effective innovation activities and creating a positional advantage in the marketplace. The present research suggests that a firms' knowledge codification strategy enhance its long-term potential by driving the proficiency of its NSD processes whereas a personalization creates a positional advantage in terms of innovativeness. The implication is that service firms cannot afford to concentrate on only one aspect because SCA requires both.

Building on the knowledge-based theory of the firm, the study results exemplify the importance of managing knowledge as both a stock and process, and how these working in conjunction with each other can improve organizational performance. NSD task



knowledge acts as a partial mediator to the relationship between the knowledge strategies and innovation performance. This demonstrates the importance of continuously renewing the firm's knowledge base, continuously replacing obsolete perspectives, systems, and procedures. Systematic efforts to retain knowledge are important as knowledge decays over time if not used (Huber 1991).

It is the interplay of existing knowledge and a personalization strategy that drives a positional advantage with respect to innovation. As Mohrman, Finegold and Mohrman (2003) demonstrated, knowledge linking (the sharing of information, maintaining organizational contacts) leads to the more effective use of existing knowledge. It is speculated that personalization may help the development team shed some of the organizational baggage that the company has previously acquired. The constant adoption of new knowledge and discarding of existing knowledge will create a type of creative destruction within the service firm.

NSD proficiency also is driven by NSD task knowledge but reinforced by a codification strategy. A codification strategy employing appropriate tools and techniques to capture and disseminate information enables a large group of people across the service firm and a wider proportion of the customer base to be connected with the development process, making better use of the knowledge the firm has. This is important as it can take organizations considerable time before everyone benefits from knowledge gained from experiences.

Whilst previous research has investigated the importance of a managing knowledge for innovation, no research has looked at the relative importance of different strategic approaches (Atuahene-Gima 2005). Results suggest that a personalization

strategy has a much stronger influence on innovation performance and on creating a SCA than a codification strategy. New services are often adapted once in the marketplace, based on real-time feedback from customers, requiring the ongoing exchange of knowledge within the organization. The sharing of tacit knowledge between the development team, customer contact staff, and customers themselves via a personalization knowledge strategy appears to have a crucial role to play in delivering the final service, and may explain why a direct link was found between a personalization strategy and SCA. Because implementation was removed from the NSD proficiency construct for statistical reasons, further research is needed here. It is possible that personalization may be more important for implementation and other customer-centric tasks.

The results also show that blending a personalization strategy with a codification strategy has a significant, albeit relatively smaller, additional benefit. An examination of the means for NSD knowledge and the three performance outcomes across four strategy groups based on high versus low scores on codification and/or personalization<sup>4</sup> affirms the potential benefit of a blended strategy (high codification/high personalization). As shown in Figure 2, a blended strategy reflects the highest values for NSD knowledge and the three performance outcomes (SCA, NSD proficiency and NSD innovativeness). The use of both personalization and codification strategies thus appears to reinforce each other. This provides empirical support for the assertion of Nonaka (1994) that knowledge is created by the interaction of tacit and explicit knowledge, as well as corresponds to the finding that structured processes benefit from rich exchanges of information and collaboration among a project's team members (Subramaniam and Venkatraman 2001).

Along with improving performance directly, a personalization strategy appears to improve how an organization's codified knowledge is leveraged, and how this knowledge is updated and reinforced, and vice-versa.

--- Insert Figure 2 About Here ---

A further contribution is an understanding as to how the impact of operant resources differs depending on the nature of the service sector and adds to our understanding of the differences between services. Banking and Telecommunications are heavily standardized where operant resources embedded into objects such as self-service delivery systems. Other services are more heterogonous and involve interpersonal exchanges. For these the precise service is customized and augmented at the point of delivery and dependent on the tacit knowledge of service providers. It was found that for such services the importance of both knowledge strategies is significantly greater. When tacit knowledge is high downstream functions, such as operations and customer service, need to be involved early in the development process for the effective implementation and delivery of new services increasing the amount of knowledge that needs to be shared. In addition, it may be that such service sectors have relatively less experience of innovation hence increasing the impact of the knowledge strategies. This may explain why these results contrast previous research which failed to find a relationship between the recording of NPD knowledge and development proficiency for tangible products (Sherman, Berkowitz and Souder 2005) which are heavily dependent on explicit knowledge.

## **Managerial Implications**

As service organizations invest considerable sums in knowledge management systems, there is a need to establish a framework for managing knowledge assets, particularly those associated with NSD task knowledge. Understanding the knowledge management strategies that can be employed to develop NSD knowledge and drive NSD performance outcomes enables service firms to strive for a sustainable competitive advantage. Indeed, Accenture and McKinsey report that the usual storage systems based around lists of best practices, reports, and PowerPoint presentations are insufficient in keeping knowledge alive (Hargadon and Sutton 2000). Given that knowledge about NSD is tacit in nature and loses much of its value when codified, a more robust strategy and corresponding information system technologies may be required.

But service firms also spend considerable time and effort bringing people together. For example, Axa Insurance created the Madhouse – a program for bringing employees from different functional areas together to encourage innovation (Oke 2002). Involving front-line staff creates its own set of problems as this interaction needs to be conducted outside normal business hours. Relying solely on oral communication alone to share knowledge can be problematic because oral communication is regarded as the prevailing source of communication errors within organizations (Hindi, Miller and Catt 2004).

If the goal is to strictly increase NSD knowledge, then either knowledge management strategy would appear to be sufficient. Yet, each strategy is found to have distinct performance outcomes, and so the respective firm needs to consider what type of NSD performance outcome is of most interest. To achieve a highly efficient NSD

capability that aims to build on and improve existing capabilities, i.e., an exploitative strategy, the firm should set up systems to codify knowledge and concentrate on creating an efficient NSD process on the back of a codification strategy. To achieve a highly innovative NSD capability that aims to spur novel innovation, i.e., an exploratory strategy, firms' should enable personal interaction and invest in a personalization knowledge management strategy. This exemplifies that firms need to align knowledge management strategies to their competitive strategies.

Whilst firms may favor either a codification strategy or a personalization strategy, study results highlight that companies might consider a blending of the two knowledge management strategies. Employing both strategies may be most advantageous to building a NSD task knowledge base within the company. Firms that rely on one strategy alone may miss some of the benefits to be derived from their knowledge resources. If employees no longer communicate personally, but only via technical means, the firm may miss out on the serendipitous ideas people have when they meet. An overreliance on meetings to drive NSD may result in project delays and new services being late to the market. To achieve a blending, firms need to put in place rewards for sharing information, and encourage the codification of knowledge to include the documenting lessons learned from past and ongoing projects. If this can be achieved, it should help create an organization responsive to change and supportive of new product initiatives, and allow the company to manifest a long-term sustainable competitive advantage.

## **Future Research**

Because this research relies on a cross-sectional perspective, a longitudinal research endeavor is prescribed to explore the impact of existing knowledge and knowledge management strategies over time. Through longitudinal study, the topic of knowledge management and NSD performance can be examined in more detail. Some suggest that a firm may need to increase its dynamic competences over time and develop the ability to constantly update and increase their level of knowledge because best practices can be imitated (Lieberman 1987; Eisenhardt and Martin 2000). Also there is a possible temporal dynamic at play. A codification strategy in the later stages of development may be able to build on a personalization strategy in the early fuzzy front end, once sufficient trust and mutual understanding has been developed. Further research can examine the possible long-run benefits corresponding to codification and personalization knowledge management strategies and NSD task knowledge for service innovation, and in doing so, create an environment of continuous improvement towards manifesting a long-run SCA. Additionally, research should examine the antecedents of effective personalization and codification strategies. The antecedents of culture, systems and rewards to encourage employees to engage in both knowledge management strategies are viable constructs to study. Coordination mechanisms, such as co-location, and their effect on the knowledge management strategies of codification and personalization are viable study points as well because mechanisms designed to aid one strategy may discourage the other.

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<sup>2</sup> The sample consisted of: Banking (17%), Insurance (15%), Telecommunications (15%), Transport (15%), IT consultancy (15%), Professional services (14%), Retailing (6%) and Utilities (4%).

<sup>3</sup> To validate the groupings respondents were asked to rate the extent to which services are adapted to individual customer requirements and the extent to which efforts are made to standardize service offerings (measured on 7-point scales). Explicit services are more standardized (4.3 v 3.3) and Tacit services are more customized (4.6 v 3.3). The differences were significant at the 1% level.

<sup>4</sup> The cases were split around the mean for the construct scores of personalization and codification giving four groups. ANOVA across these groups for NSD knowledge and the three performance outcomes were all significant at the 0.001 level.

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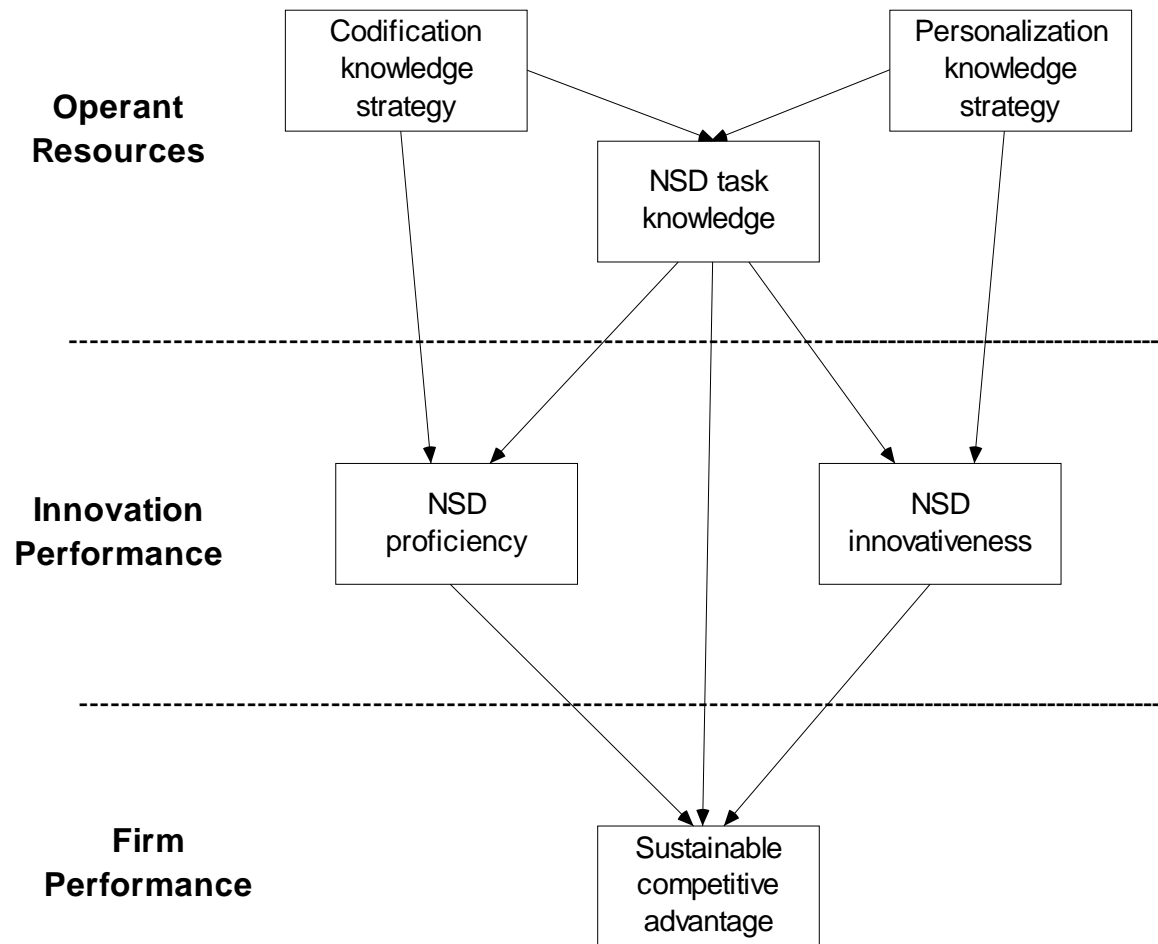
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# APPENDIX. ITEMS FOR MEASURING CONSTRUCTS IN THE MODEL

CONSTRUCTS AND COMPONENT VARIABLES	
<b>Sustainable Competitive Advantage</b> ( $\alpha = 0.86$ , CR = 0.89, VE = 0.59, HSV= 0.30) <sup>1</sup> This business's NSD programme has been successful in... <sup>2</sup>	
• Making the business more competitive	0.83
• Establishing new markets	0.68
• Ensuring the long-term viability of the business	0.71
• Achieving better utilization if resources	0.82
• Leverage sales of other products and services	0.83
• Bringing new clients to the business	0.71
• <i>Retaining existing customers</i> <sup>3</sup>	
<b>NSD Innovativeness</b> ( $\alpha = 0.77$ , CR = 0.87, VE = 0.68, HSV= 0.29) Relative to the competition...	
• This business's NSD programme is highly innovative	0.85
• This business is successful at generating innovative new service ideas	0.82
• This business is perceived by its customer to be innovative	0.81
<b>NSD Task Knowledge</b> ( $\alpha = 0.85$ , CR = 0.91, VE = 0.77, HSV= 0.41) Compared to competitive businesses, this business has:	
• greater knowledge of NSD tasks and activities	0.90
• has extensive practical experience in implementing NSD tasks and activities	0.82
• invested substantial time and money in NSD expertise	0.92
<b>Codification Knowledge Strategy</b> ( $\alpha = 0.77$ , CR = 0.86, VE = 0.60, HSV= 0.25)	
• Formal procedures exist for documenting the "lessons learned" from completed NSD projects	0.74
• NSD knowledge is generally 'stored' as new processes and routines immediately after project completion	0.81
• Manuals and handbooks are used extensively to make NSD knowledge available for subsequent use on other projects	0.71
• (NSD knowledge generally remains "in the heads" of those individuals executing the activities of the NSD project) <sup>4</sup>	0.83
• <i>During NSD written reports are used extensively to NSD knowledge</i> <sup>3</sup>	

# APPENDIX. ITEMS FOR MEASURING CONSTRUCTS IN THE MODEL Cont.

<b>Personalization Knowledge Strategy</b> ( $\alpha = 0.78$ , CR = 0.86, VE = 0.61, HSV= 0.27)	
• During NSD organizational problems are solved by inter-departmental teams	0.83
• During NSD there are high levels of communication between different parts of the organization	0.85
• During NSD co-operation between departments is usually very high	0.84
• Temporary project teams are used to manage most NSD processes	0.59
• <i>Formal group meetings occur frequently during NSD<sup>3</sup></i>	
<b>NSD Proficiency</b> (formative scale)	
• The business is proficient at NSD project management	0.54 (3.67) <sup>5</sup>
• The business is proficient at executing the following NSD tasks:	
○ Business analysis	
○ Development	0.19 (1.44)
○ Commercialization	0.23 (1.60)
○ <i>Implementation</i>	0.28 (2.18)
<b>Controls</b>	
<u>Technical Turbulence</u> ( $\alpha = 0.62$ , CR = 0.84, VE = 0.73, HSV= 0.21)	
In the markets in which this business operates:	
• It is very difficult to forecast were the technology will be in the next 5 years	0.84
• A large number of new service ideas have been made possible through technological breakthrough	0.86
<u>Market Turbulence</u> ( $\alpha = 0.70$ , CR = 0.87, VE = 0.77, HSV= 0.21)	
In the markets in which this business operates:	
• Customer's service preferences change rapidly over time	0.88
• Customers look for new services all the time	0.87
1. $\alpha$ = Scale reliability coefficient; CR – Composite reliability; VE – Average variance extracted; HSV – Highest shared variance.	
2. Scale (1) very unsuccessful (7) very successful. All other items measured on 7-point Likert scale – (1) strongly disagree, (7) strongly agree.	
3. Scale item dropped during analysis	
4. Reverse scored.	
5. t-statistic	

**Figure 1. Conceptual Model**

**Figure 2. Performance Outcomes across Knowledge Management Strategies:  
Mean Construct Scores across Groups**

		<i>High Codification</i>			
<i>Low Personalization</i>	<b>CODIFICATION STRATEGY</b> (n=16)		<b>BLENDED STRATEGY</b> (n=38)		<i>High Personalization</i>
	SCA = 5.03		SCA = 5.58		
	NSD Innovativeness = 4.88		NSD Innovativeness = 5.30		
	NSD Proficiency = 4.96		NSD Proficiency = 5.25		
	NSD Knowledge = 4.12		NSD Knowledge = 5.17		
<i>Low Personalization</i>	<b>WEAK STRATEGY</b> (n=41)		<b>PERSONALIZATION STRATEGY</b> (n=26)		<i>High Personalization</i>
	SCA = 4.40		SCA = 5.34		
	NSD Innovativeness = 4.09		NSD Innovativeness = 5.27		
	NSD Proficiency = 4.05		NSD Proficiency = 4.47		
	NSD Knowledge = 3.50		NSD Knowledge = 4.14		
		<i>Low Codification</i>			

**Table 1. Latent Variable Correlations**

	Sustainable competitive advantage	NSD innovativeness	NSD proficiency	NSD task knowledge	Codification	Personalization	Technical turbulence
Sustainable comp. adv.	-						
NSD innovativeness	0.55	-					
NSD proficiency	0.51	0.48	-				
NSD task knowledge	0.55	0.54	0.64	-			
Codification	0.36	0.30	0.50	0.48	-		
Personalization	0.52	0.45	0.43	0.51	0.36	-	
Technical turbulence	0.21	0.30	0.28	0.21	0.08	0.13	-
Sector (Tacit vs. Explicit)	(0.05)	0.04	(0.13)	(0.02)	(0.04)	(0.09)	(0.16)

**Table 2. Summary of Effects**

<u>Effect of</u>	<u>On</u> (R <sup>2</sup> - Variance explained)	<u>Direct Effect</u> (t-stat) <sup>1</sup>	<u>Total Effect</u> (t-stat)	<u>Hypothesis</u>
Codification Strategy	NSD Task Knowledge (0.378)	0.34 (4.08) **	0.34 (4.08) **	H1a supported
Personalization Strategy		0.39 (4.51) **	0.39 (4.51) **	H1b supported
Codification x Personalization		0.13 (1.43) t	0.13 (1.43) t	H2 supported
Codification Strategy	NSD Proficiency (0.481)	0.24 (2.73) **	0.42 (5.14) **	H3 supported
Personalization Strategy		-	0.20 (3.52) **	
NSD Task Knowledge		0.53 (6.63) **	0.53 (6.63) **	H5a supported
Codification x Personalization		-	0.17 (1.43) t	
Sector (Tacit vs. Explicit Services)		-0.13 (1.73) *	-0.13 (1.73) *	
Codification Strategy	NSD Innovativeness (0.368)	-	0.13 (2.77) **	
Personalization Strategy		0.23 (2.58) **	0.38 (4.98) **	H4 supported
NSD Task Knowledge		0.39 (4.70) **	0.39 (4.70) **	H5b supported
Codification x Personalization		-	0.05 (1.45) t	
Technical Turbulence		0.18 (2.20) *	0.18 (2.02) *	
Codification Strategy	SCA (0.411)	-	0.21 (3.80) **	
Personalization Strategy		-	0.26 (4.83) **	
NSD Task Knowledge		0.24 (2.24) *	0.47 (7.03) **	H8 supported
NSD Proficiency		0.20 (1.80) *	0.20 (1.85) *	H6 supported
NSD Innovativeness		0.32 (3.02) **	0.32 (3.24) **	H7 supported
Codification x Personalization		-	0.06 (1.46) t	
Sector (Tacit vs Explicit Services)		-	-0.03 (1.10)	
Technical Turbulence		-	0.06 (1.73) *	
1. t – significant at 10% level; * - significant at 5% level; ** - significant at 1% level (1-tail).				

**Table 3. PLS Results for Effect of Sector**

	NSD Innovativeness		NSD Proficiency	
	M1	M2	M3	M4
Personalization	0.24 (2.92) <sup>1</sup> **	0.22 (2.64) **	-	-
Codification	-	-	0.24 (2.77) **	0.25 (3.07) **
NSD Task knowledge	0.38 (4.14) **	0.38 (4.44) **	0.53 (6.73) **	0.51 (6.50) **
Technical turbulence	0.20 (2.41) **	0.18 (2.12) *	-	-
Sector (Tacit vs Explicit)	0.08 (1.01)	0.08 (0.97)	-0.13 (1.83) *	-0.13 (1.84) *
Personalization x Sector	-	0.18 (2.21) *	-	-
Codification x Sector	-	-	-	0.12 (1.57) t
R <sup>2</sup>	0.375	0.401	0.481	0.495
Δ R <sup>2</sup>		0.026		0.014
Δ F (sig)		4.99 (0.03)		3.22 (0.07)
f <sup>2</sup>		0.043		0.028
1. t – significant at 10% level; * - significant at 5% level; ** - significant at 1% level (1-tail).				